JAVELLIZATION

In the article by Lieut.-Col. F. W. Scheidenhelm in the JOURNAL for November, 1919, on "Keeping the First Army Supplied with Water," there is a reference to the javellization of water, which has brought a number of inquiries for further information about this treatment. Through the courtesy of the Surgeon-General of the Army the following information concerning this subject has been reproduced from appendices to a report by Lieut.-Col. Edward Bartow,[1] who was officer in charge of water analysis laboratories in the American Expeditionary Forces. In authorizing the publication of these notes, the Surgeon-General's Office called attention to features in the use of Javelle water which prevent its being considered the equivalent of the use of ampules of hypochlorite for the sterilization of water for army use. For example, it is bulky, which introduces difficulties in transportation, it is unstable and therefore requires careful control in use, and has a number of other practical disadvantages. Under certain exceptional local conditions where the solution could be standardized, as explained in the following notes, it proved useful in rendering questionable water supplies safe for drinking purposes, but the Surgeon General's Office does not endorse its general substitution for treatment by hypochlorite.

In many cases each water cart, truck, tank car or other water container used in supplying the troops in the field was treated by hand with a sufficient dose of Javelle water (a solution of sodium hypochlorite named after the French originator) to accomplish the required sterilization. Operators, trained by the Sanitary Corps officers, were supplied from the water supply companies or attached Sanitary Corps personnel. The treatment required very little equipment, a few measuring glasses, test tubes, starch iodide solution and Javelle water. These materials were generally secured from the French Service de Santé, and the glassware was calibrated and

[1] Colonel Bartow states that the report on the use of Javelle water was written by Capt. A. S. Behrman, who was in charge of field work during the St. Mihiel and Argonne operations, and that the work in Base 7 was under Capt. Weston Gavett, both of the Sanitary Corps.

the solutions prepared or standardized in the mobile laboratories. The extrait de Javelle obtained from the French contained from 40 to 65 grams of available chlorine per liter. A stock solution of 50 grams per liter was used in javellization, and the fresh supplies of varying strengths were adjusted to this standard.

For javellization of comparatively small quantities of water a weaker solution was prepared on the ground as needed, 1 cc. of which would give a dosage of 1 part per million of chlorine to 1 gallon of water. The glassware used in hand javellization was ordinarily calibrated directly in the number of cubic centimeters corresponding to the number of gallons in the common water containers, such as water carts, Lyster bags, etc. This provided a dosage of 1 part per million of chlorine, which was adjusted when necessary. For hand javellization of large quantities of water, such as railroad tank cars, the strong stock Javelle solution was employed. The hand dosage could be put into operation in less time than a liquid chlorine apparatus, and an operator with hand javellization apparatus could accompany advance parties under circumstances impossible for a mobile purification truck. For clear water, the usual dosage was 1 part per million of chlorine.

The criterion for satisfactory chlorination was that the treated water should show free chlorine for at least thirty minutes after treatment. Results were checked where practicable by bacteriological examinations. Continued experience, however, showed that with clear waters the criterion above indicated was safe. In the case of turbid waters, the dosage had to be increased.

In the St. Mihiel operations, narrow-gauge railway tank cars were filled with water at convenient points and treated with Javelle solution, after which the water was carried forward to small reservoirs in the advance, which served as filling points for water carts, etc. Immediately after the advance a scarcity of water in the vicinity of the Grande Tranchée was relieved by trucks, loaded with tanks and casks of water treated with Javelle solution, which plied on regular routes over the former no-man's-land, supplying the organizations along the route.

In the Argonne-Meuse operations water was treated with Javelle solution by hand dosing at 42 stations.

One of the most interesting instances of the use of Javelle water is given in a special report on work done in Base Section 7, where a number of camps were under construction. The works for each

camp consisted of a well, pump driven by gasoline engine, elevated tank and distribution piping. Poor results had been obtained with Lyster bag treatment, so it was decided that wherever a water system was installed all the water pumped should be sterilized, and as the supplies were small Javelle water was considered worth trying before installing a chlorine apparatus. The results were satisfactory.

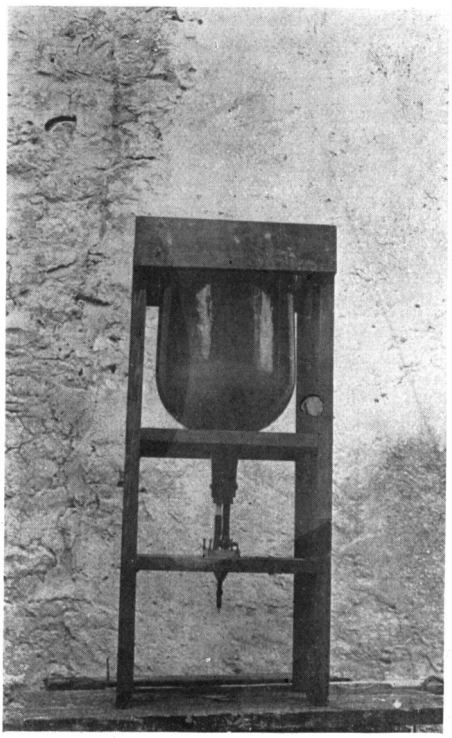
The Javelle water was made in a nearby village by a simple method using crude appliances. A chlorine solution was mixed with a sodium hydroxide solution, the strength adjusted with the aid of a hydrometer, and the solution clarified by sedimentation and filtration. The chlorine water was made by dissolving chlorine gas from a tank of liquid chlorine in a tank of water. The extract showed a strength of 25 to 45 grams of chlorine per liter, and was sold in liter bottles for household purposes, to be diluted ten times to make eau de Javelle.

An attempt was first made to regulate the dose of Javelle water by the drop method. It was found that the variation in the rate of application possible with this method was very limited, and that slow rates made it difficult to maintain a constant setting. The operator was required to regulate the flow, which introduced a chance for additional errors. It was then decided to keep the flow constant by using a fixed orifice operating under a constant head, and change the rate of application of the chlorine by altering the quantity of Javelle water added to the carboy from which the solution was fed. This reduced the duties of the operator to filling the carboy when it became empty, which did not happen more often than once in twelve hours, and keeping the orifice clean. With a smooth orifice, a smooth, even stream was obtained and any clogging was apparent.

Experiments showed that the minimum flow that could be used without excessive clogging of the orifice was 2 liters an hour under 5 inches head. For a given installation an orifice was chosen that would empty a carboy in a day or less. A 10-liter carboy was chosen finally as most generally convenient. It was supported on a wooden frame and closed by a stopper with two holes. Two short glass tubes were inserted in these holes and rubber tubes connected to them. The flow through these tubes could be stopped by pinch cocks or hard rubber valves. The tubes discharged into a funnel containing the orifice. To keep the liquid from surging too high in the funnel when air escaped into the carboy, it was found necessary to draw out the end of the air inlet tube to a small hole in order

to retard the inflow of air. The water passing through this apparatus dropped into a funnel, as shown below, from which a rubber tube conducted it into the suction pipe of the pump or into the water as close as possible to the foot of the suction pipe.

While developing this continuous-feed machine, the Javelle water was also used experimentally in treating water in Lyster bags. At



APPARATUS FOR FEEDING JAVELLE WATER, BASE SECTION 7

first a bottle of the strong Javelle extract, a bottle of test solution, a pipette and instruction sheet were furnished. They were found more easy to use than the hypochlorite of calcium tubes and the results were better. The required amount of water was added by the pipette, and after the treated water had stood for half an hour it was tested with the starch iodide solution. With the same water and bottle of extract the amount of chlorine added was practically the same for each treatment.

At one time a number of small detachments were distributed over the Base on road work, and each was supplied with a kit for javellization. This consisted of an 8-ounce bottle of Javelle extract, a bottle of starch iodide solution, a 5-cc. pipette graduated in cubic centimeters, an ungraduated pipette for the starch solution, and six cloth signs lettered "Good Water" and "Bad Water." This kit was carried in a cigar box with instructions for its use pasted on the inside of the cover. The medical officer or man in charge of water treatment for each detachment was given this kit and good results were obtained from its use. As the average dose per Lyster bag was 3 cc., the bottle of extract was sufficient for about eighty treatments.

An instance showing the convenience of the use of the extract occurred when a French pumping station at Champ de Mars was closed down. All organizations were advised to obtain water at a somewhat more distant station, but several wagons made a practice of obtaining water from a French ice plant near Champ de Mars. The water was fresh but unsafe bacterially. Therefore a man was stationed at this supply with a bottle of Javelle extract, an empty bottle and two pipettes, one for large tanks and one for small tanks. Each pipette had but one graduation mark. All the man had to do was to add the required amount of extract to the empty bottle by means of the proper pipette, fill it with water and add the solution to the tank while it was being filled. Bacterial tests of the water treated in this way showed that it was sterile.